REPAIR OF MULTIPLE BANK INSULATION

PANEL OFFICES

1. GENERAL

1.01 This section describes methods where-by grounds or crosses in panel multiple banks may be located and cleared and necessary repairs to the insulation may be made without removing the bank.

1.02 The method of locating a cross or ground involves the use of testing equipment which may be assembled and wired locally in accordance with the circuit shown in Fig. 1.

1.03 Satisfactory use of the testing equipment and repair of the insulation as covered herein requires two men.

2. APPARATUS, TOOLS AND MATERIAL

2.01 Repair kit per D-96294 consisting of the following:

D-96295 - Pocket Oiler
D-96296 - Ding Hammer
D-96297 - Insulated Drift 7/16" Wide
D-96298 - Insulated Drift 5/16" Wide
D-96299 - Cleaning Tape Holder
D-96300 - Driving Awl Haft and Wrench
D-96301 - Fibre Insulators (50 Per Package)
D-96302 - Punches (25 Per Package)
D-96303 - Fibre Drift
D-96304 - Canvass Roll
Package of KS-6528 Cleaning Tape

2.02 Mogul Varnish. The pocket oiler should be filled with this varnish and emptied when the repair work has been completed.

2.03 White or colored wax pencil or white blackboard chalk (dustless).

2.04 Test Set wired in accordance with Fig. 1, or equivalent, and containing three KS-6542 Dry Cells in good condition.

2.05 Two special W1H Cords, each 8 to 12 feet long and with the No. 38 Cord Tips replaced by No. 35 Cord Tips. These cords should be equipped, as shown in Fig. 2, with two No. 360A Tools and two KS-6278 Tools with a No. 108 Cord Tip on each. In some cases (See 3.07), a No. 411A Tool will also be required for use in place of one of the KS-6278 Tools.

2.06 Two special No. 893 Cords, each 8 to 12 feet long equipped, as shown in Fig. 2, with four No. 360B Tools, two No. 364 Tools, a KS-6278 Tool with No. 108 Cord Tip and a No. 411A Tool.

2.07 Diagonal Pliers per Spec. No. 6268.

2.08 P-Long Nose Pliers per Spec. No. 6267.

2.09 Make-busy Plugs as required.

2.10 Stick of wood about 1-1/2 feet long shaped at one end to fit between the vertical rows of terminals so that the assistant may hold the stick against the opposite surface of a multiple bank to reduce vibration in case driving operations are found to produce much vibration (see Note under 3.11).

2.11 Panel Selector Commutator Cloth per D-89026.

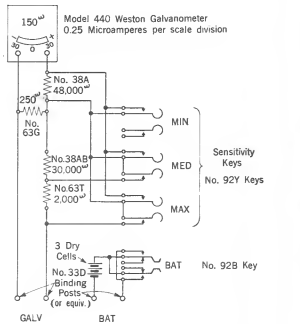

Fig. 1 - Schematic of Testing Circuit.

3. METHOD

Locating the Fault

3.01 After determining which bank and terminal punchings are involved in the trouble using any suitable method, disconnect the leads from the soldering lugs of the terminal punching or punchings affected by the trouble.

Note: Any part of the multiple which will be isolated by thus disconnecting the wiring should be made busy. In the bank in trouble, unless an open sleeve will prevent

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selectors from stopping on the terminal affected, maintain wherever possible the proper busy condition on the sleeve or sleeves of the circuits affected.

3.02 Using the testing circuit shown in Fig. 1, connect the battery leads to soldering lugs or terminals nearest to the opposite ends of a terminal punching which is grounded or crossed with another terminal punching. As shown in Fig. 2, connect the clip of the galvanometer lead so equipped to a clean part of the metal framework of the bank, if a ground is to be located; otherwise, connect this clip to any part of a second terminal punching with which the first terminal punching has been found to be crossed.

Note: Where two terminal punchings are crossed, the battery leads should usually be connected to the punching the soldering lugs of which permit these connections to be made farthest out toward the ends of the bank. The galvanometer connection is then made to the other punching. Where, however, a sleeve punching is involved in such a cross and maintenance of the busy condition is required, the test battery connection should be made to the sleeve punching.

3.03 When connections have been made as shown in Fig. 2, indicate the terminal punching to which the test battery is connected. This may be accomplished by marking a sufficient number of the terminals with a wax pencil or with chalk using it sparingly and being careful to avoid dust.

3.04 Touch the test pick, with which the second galvanometer lead is equipped, to any terminal of the terminal punching having the test battery connection. There should be no deflection of the galvanometer. A deflection would indicate the presence of a connection to an outside potential which should be removed before proceeding with the tests.

Caution: Whenever touching the galvanometer test pick to a terminal punching, exercise care to see that it is always the one marked as covered in 3.03. Should the pick come into contact with any other terminal, framework etc., damage to the galvanometer might result. Also, in all following procedures, whenever the test pick is shifted from one point to another, check to see that there is no appreciable deflection before depressing any of the sensitivity keys.

3.05 Operate the battery key of the test set and touch the test pick to either end terminal of the punching having the test battery connection. If there is an appreciable deflection proceed as in 3.06. If, however, there is no appreciable deflection, momentarily depress the key which gives minimum sensitivity. If no deflection is noted, start again from the opposite end of the same strip, where a definite deflection should be obtained.

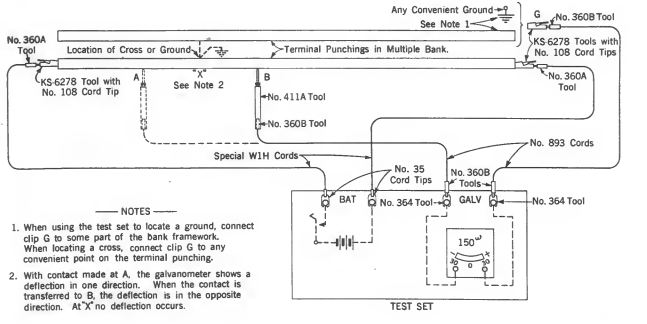
Any Convenient Ground
See Note 1
G
No. 360B Tool
No. 360A Tool
Location of Cross or Ground
Terminal Punchings in Multiple Bank.
KS-6278 Tools with No. 108 Cord Tips
KS-6278 Tool with No. 108 Cord Tip
A
"X"
See Note 2
B
No. 360A Tool
No. 411A Tool
No. 360B Tool
No. 893 Cords
Special W1H Cords
No. 35 Cord Tips
No. 360B Tools
BAT
No. 364 Tool
GALV
No. 364 Tool
150Ω
TEST SET
NOTES
1. When using the test set to locate a ground, connect clip G to some part of the bank framework. When locating a cross, connect clip G to any convenient point on the terminal punching.
2. With contact made at A, the galvanometer shows a deflection in one direction. When the contact is transferred to B, the deflection is in the opposite direction. At "X" no deflection occurs.

Fig. 2 - Arrangement of Test Connections.

3.06 With the test pick, progress gradually along the punching, advancing a few terminals at a time, and when the deflection becomes small, shift from the key giving minimum sensitivity to the one which gives medium sensitivity. When the deflection, while the key is depressed, again becomes small, shift to the maximum sensitivity key.

3.07 If after progressing terminal by terminal along the punching, a terminal is reached where the deflection is in the opposite direction, the fault lies between the two terminals which give deflections in opposite directions. If, however, the deflections remain in the same direction until the battery connection is reached, it is necessary, before continuing the tests with the galvanometer, to substitute a pick for the battery clip and thus transfer the battery connection to the extreme end of the punching.

3.08 With the test pick on the galvanometer lead sharpened, if necessary, to facilitate touching the edge of the terminal punching between terminals, continue the galvanometer tests. The indicated position of the fault is midway between the two points where equal very small galvanometer deflections are observed. It should be possible by this method to select as the position of the fault a point within a quarter of an inch of the actual location of the trouble.

3.09 Upon locating the fault, mark the location and immediately restore the battery key.

Note: To conserve the dry cells, the battery key should remain operated only while tests are in progress and the tests should be made fairly rapidly.

Repair of Defective Insulation

3.10 When ready to begin repair work, make busy the adjacent selectors to the right and left of the fault on each side of the bank.

Fault Not Close to a Tie Rod

3.11 Using the wrench provided, secure a punch in the driving awl. Moisten the punch with a little light oil by wiping it with a piece of D-89026 commutator cloth so that the compound in the bank insulation will not adhere to it and cause it to bind. By tapping the awl lightly with the hammer furnished in the tool kit, drive two holes through the insulation, one on each side of the indicated location of the fault. These holes should be approximately 1/2" apart.

Note: To prevent an objectionable amount of bank vibration during driving operations, particularly when the repair is well in toward the center of the bank, the assistant on the opposite side of the frame may, if considered necessary, steady the bank by holding against it a suitable object firmly but without appreciable pressure near the point where the force of the shocks will be greatest. See 2.10.

3.12 When the holes have been made, thus cutting the insulation in two places, drive out the intervening piece, using the hammer and the 7/16" drift. In this operation, care is necessary to avoid pushing the terminal punchings out of place. The initial movement may be facilitated if the corner of the drift is first placed in one of the holes driven through the insulation. Only light tapping should be necessary.

3.13 When the piece of insulation has been driven out, clean the aperture by means of the KS-6529 cleaning tape as follows: Lay a strip of the tape over the forked end of the cleaning tape holder and push it through to the opposite side of the bank where the assistant will pull one end through. Then withdraw the tool and while the tape is kept taut, work it several times back and forth.

3.14 At this point, again make tests with the galvanometer, as in 3.05. If there is a deflection, it indicates that trouble is still present. If the trouble has persisted, again proceed, as in 3.06 to 3.09 to locate it. Additional insulation should then be removed or more cleaning done, as required, in accordance with 3.11 to 3.13.

3.15 With the diagonal pliers, cut a strip of new insulation to the proper length to replace the insulation removed. See Fig. 3. Cover the new piece of insulation with a thin coating of Mogul varnish.

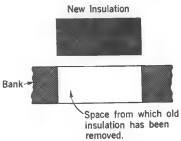

Fig. 3 - Section of Bank Showing Insulation Replacement.

3.16 Holding the new piece of insulation in the long nose pliers, force the edge of it into the space from which the old insulation has been removed. Drive it into place, using the fibre drift provided, and tapping the drift gently with the hammer.

3.17 When the new insulation is in place, repeat the test with the galvanometer, as covered in 3.05, to be sure that the circuit is clear of trouble.

3.18 Unless the crevices between the new piece of insulation and the terminal punchings are well sealed with varnish, apply by means of the pocket oiler enough varnish to the edges of the new piece of insulation to cover all crevices.

Fault At or Near a Tie Rod

3.19 When the test indicates that a cross or ground is located at or within about one-quarter of an inch of one of the tie rods which run vertically at intervals through the bank, insulation should be removed as covered in the following paragraphs:

3.20 With the driving awl, punch and hammer, cut the insulation as close on each side of the tie rod as can be done without danger of damage to the rod bushing. Also cut the insulation far enough away from the rod on each side so that the pieces of insulation can be driven out with the 5/16" drift without damaging the bushing. If the indicated location of the fault is to one side of the rod, the cut on that side should be somewhat farther from the rod in order to improve the chance of removing the trouble on the first attempt.

3.21 Using the 5/16" drift, drive out the insulation on each side of the rod and the small piece behind the rod. Working from the opposite side of the bank, push out the small remaining piece of insulation. In this work injury to the rod bushing should be avoided as the bushing may not be involved in the trouble.

3.22 Lay a strip of cleaning tape over the forked end of the cleaning tape holder and push it through to the opposite side of the bank. Have the assistant pull one end through and clean the apertures on each side of the rod as covered in 3.13. Unless the bushing has been cut away, this tape should not be run around the rod so that both ends are on the same side of the bank.

3.23 Test with the galvanometer, as in 3.05. If trouble is still present, proceed again as in 3.06 to 3.09. If the tie rod bushing is found to be defective, parts of it should be removed as required.

Note: To remove defective parts of bushings, it may be necessary in some cases to remove insulation as in 3.19 to 3.22 from between more than one pair of terminal punchings.

3.24 Cut a new piece of insulation as shown in Fig. 4 and put it in place as covered in 3.16. All crevices should be well sealed with Mogul varnish, particularly where it has been necessary to remove part of an insulating bushing of a tie rod.

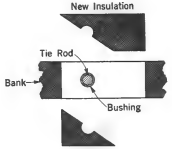

Fig. 4 - Method of Replacing Insulation at Position of Tie Rod.

3.25 Again test as in 3.05 to be sure that no crosses or grounds are present. Reconnect the multiple wiring. Restore to service all equipment made inoperative to facilitate the repair work. When suitable tests have shown that the circuit or circuits originally in trouble are in satisfactory condition, they may be placed in service.